

REMARKS

Claims 4, 6, 10-11, 17-24, 29-30 and 42-53 are pending.

Claims 1-3, 5, 7-9, 12-16, 25-28, and 31-41 are cancelled.

Claims 4, 6, 10-11, 17-24, 29-30 and 42-44 are rejected.

Claims 42-44 are objected to.

Claims 45-53 are new.

Claim Amendments

Claims 4, 6, 10-11, 17-24, 29-30 and 42-44 have been amended. Claims 45-53 are new. Support for the amendments may be found in the application as filed, for example, on pages 44-47, 50-51, and 57-58. No new matter has been added.

Applicant respectfully requests reconsideration of the claims in view of the foregoing amendments and following remarks.

Examiner Interview

The undersigned wishes to acknowledge with appreciation the interview conducted on March 15, 2006 between Derek Meeker, an attorney for the Applicant, and the Examiner. The interview included discussions of the rejections, including an explanation of interpretations by the Examiner concerning the breadth afforded certain claim terms, and possible claim amendments clarifying the invention over the prior art.

Claim Rejections – 35 U.S.C. § 101

Claims 6, 21, 30, 36 and 43 are rejected under 35 U.S.C. 101 for claiming non-statutory subject matter is maintained. According to the Examiner's suggestion, claims 6, 21, 30, 36 and 43 and their dependent claims have been amended to claim "a computer storage apparatus" rather than a "computer storage medium". As a result claims 6, 21, 30, 36 and 43 should now be directed toward statutory subject matter.

Claim Rejections – 35 U.S.C. § 112

Claims 10-11 are rejected under the first paragraph of 35 U.S.C. 112 for not conveying a concise and exact definition of the term "virtual block allocation structure." As amended, the

term “virtual block allocation structure” has been removed and no longer appears in claims 10 and 11. Accordingly, the Applicant respectfully requests that the Examiner withdraw the rejection of claims 10 and 11.

Claim Objections

Claims 42-44 are objected to because it is not clearly understood what is meant by “a plurality of previous current sets” in the amended claims 42-44. Claims 42-44 have been amended to clarify the claimed subject matter and remove the term “a plurality of previous current sets.” Accordingly, the Applicant respectfully requests that the Examiner withdraw the objection of claims 42-44.

Claim Rejections – 35 U.S.C. § 102

Claims 4, 6, 10-11, 17-24, 29-30 and 42-44 have been rejected under 35 USC §102 or §103 on the grounds that each and every limitation is shown within the prior art, including for specific claims the Stallmo and Ofek references discussed in more detail below. Applicants traverse these rejections on the grounds that the following limitations, *inter alia*, are clearly not found within the prior art of record and that the claims should thus be in allowable form:

- Claim 4 recites “storing a changed logical block number in a buffer in the mirroring unit.” Claim 47, dependent on claim 4, includes changing from storing change data in the buffer to storing the changed logical block number instead of the change data if the storage in the buffer passes a threshold. No such change or threshold is described in Ofek.
- Claim 29 recites “reading a block of data from a mirror, wherein a first logical block number corresponding to a first logical block on the mirror storing the block of data is already a part of an existing entry in a queue.” Claim 52, dependent on claim 29, recites “reading the block of data from the mirror further comprises reading the block of data from a full mirror of a storage volume on the host.” Since the queues of Ofek only point to the cache, no first logical block number that could be in those queues points to a full mirror of a storage volume on the host.
- Claim 42 recites “creating a set of mirrored data elements in a mirroring unit, and maintaining an ordered queue of change data in the mirroring unit.” Claim 45, dependent on claim 42, recites “storing the set of mirrored data elements as modified by the selected

entry and any older entries of the ordered queue in the mirrored volume.” No modifying of the set of mirrored data elements using ordered queue entries and storing that modified set in a mirrored volume is described in Ofek.

An analysis of all pending claims, their limitations, and the inapplicability of the prior art to the teachings of the claims, is included below.

Stallmo

Claims 17-24 are rejected under 35 U.S.C. 102(b) as being anticipated by Stallmo et al U.S. Patent No. 5,787,459 (“Stallmo”).

As amended, claim 17 recites a method including “monitoring a first bus over which a host and a first storage volume for the host communicate; and buffering a communication on the first bus between the host and the first storage volume.” An MCU 203 of Stallmo is the only device that may “snoop” or monitor communications on the host bus 207. No buffering by an MCU 203 of a communication between the host computer 201 and a stand alone data storage device 205 is described.

A node 213 may appear to be an independent device. *Stallmo, col. 5, ll. 1-6*. However, No MCU 203 is described as buffering communications between the host computer 201 and another node 213. When a communication occurs between the host computer 201 and another node 213, control is transferred to the other node 213. *Stallmo, col. 12, ll. 11-34*.

Claim 17 includes “repeating the communication to a second storage volume in a mirroring unit through a second bus.” Even if an MCU 203 is communicating with the host computer 201 and that is read as buffering the communication, the communication is not repeated to a second storage volume through a second bus. At most data is written to a data storage device 209 of a node 213. *Stallmo, col. 12, ll. 19-22*. Nothing indicates that the write is repeating the communication buffered from the host bus 207.

Claim 20 recites “repeating the communication to a third storage volume in an additional mirroring unit through a third bus.” The Examiner has argued that “inherently the captured read/write command is buffered so as to be relayed to other MCUs.” Thus, the Examiner’s remarks indicate that there is no explicit mention of relaying communications to other MCUs.

It is not necessary to the operation of Stallmo that communications be repeated between MCUs. "To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.' " *MPEP 2112 Section IV quoting In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999). Stallmo does disclose some communications between MCUs. "Operational" messages, "configuration change" messages, a command to service a request, and other communications are described between MCUs. *See Stallmo, col. 10-12*. None of these or similar communications include a communication between a host and a storage volume.

Claims 21-24 include similar elements as claims 17-20. As a result, Stallmo does not teach each and every element of claims 17-24. The Applicant respectfully requests that the Examiner withdraw the rejection of claims 17-24.

Ofek

Claims 4-8, 29-31, and 42-44 are rejected under 35 U.S.C. 102(e) as being anticipated by Ofek et al. U.S. Patent No. 5,889,935 ("Ofek").

Claim 4 includes "receiving change data from a source, the change data received in a mirroring unit; and storing a changed logical block number in a buffer in the mirroring unit, the changed logical block number indicating a logical block on the source corresponding to the change data." Claim 6 includes elements similar to claim 4. The Examiner cites the LRU queue 503 or the link transmission queue 504 as the buffer. The link transmission queue 504 may contain pointers to data in cache. *Ofek, col. 17, ll. 20-23*. The LRU queue 503 contains pointers to cache blocks that are available to be allocated. *Ofek, col. 36, ll. 34-36*. Thus, both the LRU queue 503 and the link transmission queue 504 may include pointers to the cache.

However in claim 4, the changed logical block number that is stored in the buffer indicates a logical block on the source. Thus, for the pointers in the LRU queue 503 and the link transmission queue 504 to point to a source, the cache must be the source. At best, data from the cache may be received in the secondary data storage system 246. However, the change data is received in a mirroring unit. The mirroring unit includes the buffer. Thus, if the data from the

cache is received in the secondary data storage system 246, it must be the mirroring unit, however, the LRU queue 503 and the link transmission queue 504 are not in the secondary data storage system 246. As a result, Ofek does not teach each and every element of claim 4.

Claim 47, dependent on claim 4, recites “storing change data in the buffer if a remaining storage in the buffer is greater than a threshold” and storing the changed logical block number in the buffer instead of the change data if the remaining storage in the buffer is less than the threshold.” No change to switch from storing the change data in the buffer to storing the changed logical block number in the buffer instead of the change data is described in Ofek. Furthermore, no such threshold where such a change may occur is described in Ofek.

Claim 48, dependent on claim 4, recites “receiving the change data from a local mirror, the local mirror including a mirror of a storage volume of a host.” No local mirror is described in Ofek. Furthermore, the cache cannot be read as the local mirror. As described above, the cache cannot be the source. In claim 48, the source is the local mirror. Thus, the cache cannot be the source.

Claim 49, dependent on claim 4, recites “receiving the change data from a host, the change data corresponding to a data change on a storage volume of the host.” Thus, the source is the host. The LRU queue 503 and the link transmission queue 504, which may contain pointers to the cache, are not described as containing logical block numbers corresponding to logical blocks on the storage volume of the host.

Claim 50, dependent on claim 4, recites “receiving the change data further comprises receiving the change data corresponding to a change in a block referenced by a changed logical block number entry already in the buffer,” and “changing the changed logical block number entry from the changed logical block number to another logical block number, data in the block before the change stored in a location referenced by the other logical block number.” No such changing of a logical block number entry in a queue is described in Ofek. Furthermore, no such other block number is described indicating where the data before the change is stored.

Claim 10 as amended recites “the means for storing the changed logical block number further comprises a data structure including block checksums corresponding to the change data.” Storing such checksums corresponding to the change data is not shown in Ofek.

Claim 11 as amended recites “means for transmitting the block checksums across a journey link to a mirroring unit rather than transmitting change data across the journey link

during a resynchronization of the mirroring unit and the computer storage apparatus.” No such transmissions of the block checksums during resynchronization of the mirroring unit and the computer storage apparatus is described in Ofek.

Claim 29 recites “receiving change data; reading a block of data from a mirror, wherein a first logical block number corresponding to a first logical block on the mirror storing the block of data is already a part of an existing entry in a queue; writing the block of data to a second logical block on a temporary storage.” The first logical block number corresponds to the first logical block on the mirror. The second logical block number corresponds to a second logical block on the temporary storage. As described above, the pointers of the LRU queue 503 and the link transmission queue 504 point to the cache. In order for the pointers of the queues of Ofek to correspond to the first and second logical block numbers, the mirror and the temporary storage must both be part of the cache. However, the block of data stored in the first logical block is written to a block of data indicated by the second logical block number. Thus, the block of data is copied from one portion of the cache to another portion of the cache. No such copying within the cache is described in Ofek.

In addition, Claim 29 recites “changing the existing entry in the queue to reference a second logical block number corresponding to the second logical block on the temporary storage.” The channel adapter gets an entry for the link queue that is a free block of cache memory. *Ofek, col. 39, ll. 22-23*. Before this link queue entry is de-allocated, no change is described in Ofek changing the pointer of that queue entry. Thus there is no changing of logical block numbers of entries of queues is described in Ofek.

Claim 30 includes similar elements as claim 29.

Claim 52, dependent on claim 29, recites “receiving the change data further comprises receiving the change data from a host; and reading the block of data from the mirror further comprises reading the block of data from a full mirror of a storage volume on the host.” Thus, the first logical block number indicates a logical block on a full mirror of a storage volume. As described above, in Ofek, the pointers of the LRU queue 503 and the link transmission queue 504 point to the cache. Even if the data in the cache is assumed to be a mirror, it is not a full mirror of the storage volume, it is a queue for transmitting data to a remote data storage system. *Ofek, col. 17, ll. 18-26*.

Claim 42 recites “creating a set of mirrored data elements in a mirroring unit, the first set of mirrored data elements including all data of a mirrored volume at a first time; maintaining the set of mirrored data elements; and maintaining an ordered queue of change data in the mirroring unit, wherein a combination of at least one entry of the ordered queue and the set of mirrored data elements includes all data of the mirrored volume at a second time.” Claims 43 and 44 include similar elements. Thus, the mirroring unit includes both a set of all data of a mirrored volume at a first time and a queue of change data. No such collection of data is described in Ofek.

Claim 45, dependent on claim 42, recites “selecting an entry of the ordered queue; and storing the set of mirrored data elements as modified by the selected entry and any older entries of the ordered queue in the mirrored volume.” Even if Ofek describes the set of mirrored data elements and ordered queue of claim 42, no such modification of the set of mirrored data elements and a storing of the set into the mirrored volume is described in Ofek. Although Ofek may describe recovering a primary volume R1 from a secondary volume R2, the recovery is not made using the set of mirrored data elements and entries of the ordered queue.

As a result, Ofek does not teach each and every element of claims 4, 6, 10, 11, 29, 30, and 42-53. The Applicant respectfully requests that the Examiner withdraw the rejections of claims 4, 6, 10, 11, 29, 30, and 42-53.

Claim Rejections – 35 U.S.C. § 103

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ofek as applied to claims 4-8, 29-31, and 42-44 above, further in view of Beal et al. U.S. Patent No. 6,237,008.

Claim 9 has been cancelled, thus obviating this rejection.

Conclusion

For the foregoing reasons, reconsideration and allowance of claims 4, 6, 10-11, 17-24, 29-30 and 42-53 of the application as amended is solicited. The Examiner is encouraged to telephone the undersigned at (503) 222-3613 if it appears that an interview would be helpful in advancing the case.

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Respectfully submitted,

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A handwritten signature in black ink, appearing to read 'Derek Meeker', is written over a horizontal line.

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